Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Navy											Date: February 2016	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 1: *Basic Research*					R-1 Program Element (Number/Name) PE 0601152N / *In-House Lab Independent Res*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	18.998	19.126	18.508	-	18.508	19.438	19.434	19.440	19.441	Continuing	Continuing
0000: *In-House Lab Independent Res*	0.000	18.603	19.126	18.508	-	18.508	19.438	19.434	19.440	19.441	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.395	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.395

A. Mission Description and Budget Item Justification

This program element (PE) sustains U.S. Naval Science and Technology (S&T) superiority by providing new technological concepts for the maintenance of Naval power and national security, and by helping to avoid scientific surprise while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNCs). The Department of Navy (DON) component responds to S&T directions of the Naval S&T Strategic Plan for long term Navy and Marine Corps improvements and is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command and the Marine Corps Combat Development Command. It enables technologies that significantly improve the Joint Chiefs of Staff's Future Joint Warfighting Capabilities. The In-house Laboratory Independent Research (ILIR) program also adds increased emphasis to the revitalization of the scientist and engineer workforce component at the Navy's Warfare Centers and Laboratories by attracting superior candidates and retaining our best members through the provision of exciting and meaningful work.

This PE addresses DON Basic Research, which includes scientific study and experimentation directed toward increasing knowledge and understanding in national-security related aspects of physical, engineering, environmental, and life sciences, and is the core of Discovery and Invention. Basic research projects are developed, managed, and related to more advanced aspects of research in some hundred-plus technology and capability-related 'thrusts', which are consolidated in thirteen research focus areas: Power and Energy; Operational Environments; Maritime Domain Awareness; Asymmetric and Irregular Warfare; Information, Analysis and Communication; Power Projection; Assure Access and Hold at Risk; Distributed Operations; Naval Warfighter Performance and Protection; Survivability and Self-Defense; Platform Mobility; Fleet/Force Sustainment; Affordability, Maintainability and Reliability.

This portion of the DON Basic Research Program provides participating Naval Warfare Centers and Laboratories with funding for: basic research to support the execution of their assigned missions; developing and maintaining a cadre of active researchers who can distill and extend results from worldwide research and apply them to solve Naval problems; promoting hiring and development of new scientists; and encouragement of collaboration with universities, private industry, and other Navy and Department of Defense laboratories.

ILIR efforts are selected by Naval Warfare Centers/Lab Commanding Officers and Technical Directors near the start of each Fiscal Year through internal competition. Efforts typically last three years, and are generally designed to assess the promise of new lines of research. Successful efforts attract external, competitively awarded funding. Because the Warfare Centers and Labs encompass the full range of naval technology interests, the scope of ILIR topics roughly parallels that of PE 0601153N, Defense Research Science.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Navy	Date: February 2016
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601152N *I In-House Lab Independent Res*

In FY15 the ILIR PE 06011652N was simplified from seven Naval technology interests (advanced materials, electronics sensor sciences, energy sciences, human performance sciences, information sciences, naval platform design sciences, and ocean/space sciences) into one encompassing ILIR program. It is still possible to report which naval technology interest each project falls under. Due to the number of efforts in PE 06011652N, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	19.142	19.126	19.499	-	19.499
Current President's Budget	18.998	19.126	18.508	-	18.508
Total Adjustments	-0.144	0.000	-0.991	-	-0.991
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.145	0.000			
• Rate/Misc Adjustments	0.001	0.000	-0.991	-	-0.991

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: 9999: *Congressional Adds*		
Congressional Add: *Program Increase*	0.395	0.000
Congressional Add Subtotals for Project: 9999	0.395	0.000
Congressional Add Totals for all Projects	0.395	0.000

Change Summary Explanation

The FY 2017 request was reduced by -$0.573 million as required for the Department of the Navy to comply with the Bipartisan Budget Act of 2015.

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy			Date: February 2016
Appropriation/Budget Activity 1319 / 1	R-1 Program Element (Number/Name) PE 0601152N / *In-House Lab Independent Res*	Project (Number/Name) 0000 / *In-House Lab Independent Res*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
0000: *In-House Lab Independent Res*	0.000	18.603	19.126	18.508	-	18.508	19.438	19.434	19.440	19.441	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project sustains U.S. Naval S&T superiority, provides new technological concepts for the maintenance of naval power and national security, and mitigates scientific surprises, while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNC's). It responds to S&T directions of the Naval S&T Strategic Plan for long term Navy and Marine Corps improvements. It is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command (NWDC) and the Marine Corps Combat Development Command (MCCDC), and enables technologies that significantly improve the Joint Chiefs of Staff's Future Joint Warfighting Capabilities.

This portion of the DON Basic Research Program provides participating Naval Warfare Centers and Laboratories with funding for basic research to support the execution of their assigned missions, for developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to naval problems, to promote hiring and development of new scientists, and to encourage collaboration with universities, private industry, and other Navy and Department of Defense laboratories.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)	16.130	16.601	16.065	0.000	16.065
Description: Starting in FY 2015, these requirements have been consolidated into a separate R-2 project to provide greater visibility of the program by providing an easily navigable overview of all In-House Laboratory Independent Researc(ILIR) Programs in a single location. Funding increase in FY 2016 is due to rebalancing programs within the Program Element. ***FY 2015 Accomplishments:*** -Continued research for polymer materials to understand improved helmet blast protection. -Continued fundamental research for composite materials for reduced signature for undersea vehicles. -Continued research for the fundamental understanding of graphene type Radio Frequency (RF) Antennas. -Continued fundamental research for the understanding of optimization of undersea sensor distribution in littoral environments. -Continued research for understanding effects of energetic materials under high pressure environment. -Continued research on Operational Fatigue of Warfighters due to Stress Environments. -Continued research on Human Gesture and Computer Interface and Functionality.					

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601152N / *In-House Lab Independent Res*	**Project (Number/Name)** 0000 / *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
-Continued research framework for Efficient Quantum Computing. -Continued research for Autonomous Routing of Unmanned Vehicles. -Continued fundamental research for undersea imaging and analysis. -Continued research for modeling super-cavitation of Advanced Propulsor Designs. -Continued research for Predictive Performance Modeling of Advanced Naval Hull Designs. -Continued research for Design and Performance of High Speed Naval Vessels. -Continued research for Advanced Smart Wireless Cooperative Vehicular Network. -Continued research for Undersea Laser Communication and Identification in Littoral Environments. -Continued ILIR projects that are intended to be approximately three years in length researching littoral geosciences, optics, and biology; marine mammals; ocean acoustics; and autonomous systems. -Initiated FY 2015 ILIR projects that are intended to be approximately three years in length to research topics including: Structural materials, functional materials, maintenance reduction, hydrodynamics, power generation, energy conservation and conversion. -Complete research to develop broadband dynamically controllable artificial dialetrics. -Sensing, diagnostics, and detectors; navigation and timekeeping; nano electronics; real time targeting, Electro-Optical/InfraRed (EO/IR) electronics; EO/IR electronic warfare; and EO/IR sensors for surface and subsurface surveillance. -Undersea weaponry, energetic materials and propulsion, directed energy, and TeraHertz Time-Domain Spectroscopy (THz-TDS) technology that addresses overseas contingency operations and Counter Improvised Explosive Device (C-IED) detection by detecting and spectroscopically identifying military and home-made explosives and formulations. -Biosensors, biomaterial, bioprocesses; marine mammals; casualty care management, undersea medicine; human factors and organizational design; manpower, personnel and advanced cockpit; and operational training and education. These efforts are coordinated with the Navy Medical Research Center (NMRC). -Mathematical foundation and computational theory and tools for design communications, decision support theory, algorithm and tools, information assurance, secure and reliable infrastructure for command and control, mathematical optimization for optimal resource allocation and usage, modeling and computational propagation, seamless, robust connectivity and networking and cyber warfare. -Novel hull forms, materials, structures and signatures; and virtual shaping concepts for structures and platforms. -Littoral geosciences, optics, and biology; marine mammals; ocean acoustics; and autonomous systems. -Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering.					

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601152N / *In-House Lab Independent Res*	**Project (Number/Name)** 0000 / *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
-Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. -Command and Control and connectivity research. - Initiated research for polymer materials to understand improved helmet blast protection. - Initiated fundamental research for composite materials for reduced signature for undersea vehicles. - Initiated research for the fundamental understanding of graphene type Radio Frequency (RF) Antennas. - Initiated research for complex unmanned sensor networks.					
FY 2016 Plans: - Continue all efforts of FY 2015, less those noted as completed above. - Initiate FY 2016 ILIR projects that are intended to be approximately three years in length to research topics including : - Structural materials, functional materials, maintenance reduction, hydrodynamics, power generation, energy conservation and conversion. - Sensing, diagnostics, and detectors; navigation and timekeeping; nano electronics; real time targeting, Electro-Optical/InfraRed (EO/IR) electronics; EO/IR electronic warfare; and EO/IR sensors for surface and subsurface surveillance. - Undersea weaponry, energetic materials and propulsion, directed energy, and TeraHertz Time-Domain Spectroscopy (THz-TDS) technology that addresses overseas contingency operations and Counter Improvised Explosive Device (C-IED) detection by detecting and spectroscopically identifying military and home-made explosives and formulations. - Biosensors, biomaterial, bioprocesses; marine mammals; casualty care management, undersea medicine; human factors and organizational design; manpower, personnel and advanced cockpit; and operational training and education. These efforts are coordinated with the Navy Medical Research Center (NMRC). - Mathematical foundation and computational theory and tools for design communications, decision support theory, algorithm and tools, information assurance, secure and reliable infrastructure for command and control, mathematical optimization for optimal resource allocation and usage, modeling and computational propagation, seamless, robust connectivity and networking and cyber warfare. - Novel hull forms, materials, structures and signatures; and virtual shaping concepts for structures and platforms. - Littoral geosciences, optics, and biology; marine mammals; ocean acoustics; and autonomous systems. - Tailoring Instruction to the Individual: Investigating the Utility of Trainee Aptitudes for use in Adaptive Training. - Research to Improve Situational Awareness Using Learned Representations and Autonomous Systems.					

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601152N / *In-House Lab Independent Res*	**Project (Number/Name)** 0000 / *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
- Developing Novel Propellants for Solid Ramjet Application. - Anomalous Capacity Loss and Recovery in Lead Acid Batteries Following Rapid Pulsed Discharge Power and Energy. - Research of n+InP as a Possible New Semiconductor Material for Fast Neutron Spectroscopy. - Polarimetric Radar Cross Section Control. - Broadband Prewhitening Filtering Framework to Improve Beamforming Detection Performance inLinear Arrays under reduced Snapshot Support Conditions. - Automated Storytelling: Co-clustering of Topic Models for Topic Detection and Tracking - Developing the Theory of Superabsorption. - Topological Methods for the Analysis of Big Data. - Complete Development of a Unified Theory for Multiphase Flows - Complete Mechanistic Studies of Alane Decomposition - Neutralization Using Air-Deployable Self-surveying UUV - Optimized Waterspace Management & Scheduling for Heterogeneous Teams of Autonomous Vehicles. - Secure Underwater Communications Study for the Advanced Undersea Weapons (AUWS). - Acoustic Reception and Transmission in High Speed Flows. - Beamforming with Arrays of Sensor Elements with Uncertain Location. - Develop Design, Testing, and Analysis of Zero Poisson Ratio Metamaterials - Beam Space Multiple Input Multiple Output. - Graphene Broadband Infrared Light-Emitting Devices. - Machine Learning of Autonomous Vehicle Tactics through Human Evaluation. - Nomad: A Hybrid-Cloud Aware High Assurance and Availability Cloud Service. - Nonvolatile and Cryogenic Compatible Quantum Memory Devices. - Stochastic Compiler Hacks as Software Immunization Mechanisms (SCHSIM). - Energy Harvesting for Future E - Projects selected for FY 2016 will focus on supporting: - Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering. - Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.					

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601152N / *In-House Lab Independent Res*	**Project (Number/Name)** 0000 / *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
- Command and Control and connectivity research. ***FY 2017 Base Plans:*** -Continue all efforts of FY 2016, less those noted as completed above. -Complete FY 2015 ILIR projects which were three years in duration. -Continue ILIR projects started in FY2016. -Initiate FY 2017 ILIR projects that are to be approximately three years in length. ***FY 2017 OCO Plans:*** N/A					
Title: SCIENCE TECHNOLOGY ENGINEERING AND MATH (STEM) EFFORTS AT NAVY LABS ***Description:*** This effort will support both the Science and Engineering Apprenticeship Program (SEAP) and the Naval Research Enterprise Intern Program (NREIP) summer programs to encourage participating students to pursue science and engineering careers, to further their education via mentoring by laboratory personnel and their participation in research, and to make them aware of DoN research and technology efforts, which can lead to employment within the DoN. Participating students will spend eight to ten weeks during the summer doing research at approximately 19 to 20 DoN laboratories. Participants will receive a stipend distributed by the Contractor. The stipend is a monthly allowance paid to interns for their participation in the research efforts. This activity was separated from ILIR in FY 2013 to highlight Science Technology Engineering and Math (STEM) efforts at Navy labs previously funded within the Ocean/Space Sciences activity in this PE. Funding increase in FY 2015 results from temporary augmentation of STEM within the PE, but the FY 2016 decrease plan rebalances the PE to focus on the NREIP and SEAP programs, scaling back on other STEM efforts. ***FY 2015 Accomplishments:*** - Continued Naval Research Enterprise Intern Program (NREIP) to support undergraduate and graduate students performing Navy-related research at Naval Warfare Centers under the supervision and mentorship of DON Scientists, thus exposing them to interesting and challenging work done at the centers. NREIP is a continuing Navy education program. - Continued Science and Engineering Apprenticeship Program (SEAP) supporting high school student programs. - Continued Science, Technology, Engineering and Mathematics (STEM) projects that are intended to be approximately three years in length. Projects selected for STEM funding will focus on engaging and educating future Naval scientists and engineers and incorporating naval relevance,	2.473	2.525	2.443	0.000	2.443

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 1	**R-1 Program Element (Number/Name)** PE 0601152N / *In-House Lab Independent Res*	**Project (Number/Name)** 0000 / *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
diversity, and STEM best practices. These efforts complement and support the ongoing independent research, education and outreach efforts taking place at the naval laboratories. ***FY 2016 Plans:*** - Continue all efforts of FY 2015, unless noted as completed above. ***FY 2017 Base Plans:*** - Continue all efforts of FY 2016, unless noted as completed above. ***FY 2017 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	18.603	19.126	18.508	0.000	18.508

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The ILIR initiative seeks to improve the quality of defense research conducted predominantly through the Naval Warfare Centers/Laboratories. It also supports the development of technical intellect and education of engineers and scientists in disciplines critical to national defense needs through the development of new knowledge in a military laboratory environment. Initial research focus is often conducted in an unfettered environment since it is basic research, but many projects focus on applying recently developed theoretical knowledge to real world military problems with the intention of developing new capabilities and improving the performance of existing systems. Individual project metrics then become more tailored to the needs of specific applied research and advanced development programs. The National Research Council of the National Academies of Science and Engineering's Congressionally directed "Assessment of Department of Defense Basic Research" concluded that the DoD is managing its basic research program effectively.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy			Date: February 2016
Appropriation/Budget Activity 1319 / 1	R-1 Program Element (Number/Name) PE 0601152N / *In-House Lab Independent Res*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.395	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.395

A. Mission Description and Budget Item Justification

This Congressional increase will help sustain U.S. Naval Science and Technology (S&T) superiority by providing new technological concepts for the maintenance of Naval power and national security, and by helping to avoid scientific surprise while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNCs). The In-house Laboratory Independent Research (ILIR) program also adds increased emphasis to the revitalization of the scientist and engineer workforce component at the Navy's Warfare Centers and Laboratories by attracting superior candidates and retaining our best members through the provision of exciting and meaningful work.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase	0.395	0.000
FY 2015 Accomplishments: Continued efforts for the In-house Laboratory Independent Research (ILIR) program.		
FY 2016 Plans: N/A		
Congressional Adds Subtotals	0.395	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

The ILIR initiative seeks to improve the quality of defense research conducted predominantly through the Naval Warfare Centers/Laboratories.

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